Catagorization of Project Success Factors According to Project Characteristics

Insights from 21 project cases from Norway

In press

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Abstract— *The aim of this study is to establish a framework that link project success factors to 5 project characteristics that has been identified from the project management literature. These characteristics include; organizational complexity, transformation, impact on business, constraints, and uncertainty. The study is based on analysing 21 project cases from a wide spectrum of applications and industries in Norway.* In total, c.120 business professionals contributed to the analysis of the cases in order to establish the framework through group work, individual assignments, and group discussions under supervision of the author. For each project characteristics we have identified a set of context dependent success factors that must be adhered to in order to increase the likelihood of success. In addition, the findings suggest that success is also dependent on having a good working environment in which project team members improve their tasks continually. A good working environment that is characterized by openness, respect, loyalty, trust and dedication has considerable influence on motivation, creativity, cooperation, unity, sense of ownership, and knowledge sharing. Lack of these values could cause power struggles, resistance, indifference, and ultimately failure in projects.

1 INTRODUCTION

There are many studies have examined and identified critical success factors (CSFs) in projects [1]. One category of these studies has examined success factors for specific types of projects, such as product development projects [2] and ICT projects [3, 4]. A number of other studies have examined the effects of specific factors on project success, regardless of the type of project. For example, Müller and Turner [5] examined the relevance of management skills and attitudes for project success. Prabhakar [6] examined the effects of alternating leadership on success in projects across 28 nations. Gemünden, Salomo and Krieger [7] examined the influence of autonomy on project success in new product development. Yang, et al. [8] studied the effect of good stakeholder analysis on success in building projects. The contribution of

teamwork quality to the success has been examined by Hoegl and Gemuenden [9]. Other studies have focused on generic success factors in projects, such as the one conducted by Murphy, Baker and Fisher [10]. Pinto and Slevin [11] formulated the project implementation profile (PIP), a 10-factor instrument that they have found predictive of project success. Pinto and Prescott [12] show that the relative importance and significance of the above-mentioned success factors will vary in the project life cycle and that, for example, project mission was significant for success across all of the project stages. The article by Pinto and Prescott [12] has contributed to enabling project managers to identify specific CSFs to focus on during the project life cycle [13]. Others, such as Munns and Bjeirmi [14] have credited project success to the involvement and commitment of both the client and the contractor. Belassi and Tukel [15] have developed some important relationships between success criteria and factors. For example, they argue that good communication between team members is critical when the execution time is the most important success criterion. Dvir and Lechler [16] conclude that planning and control are the key success factors if the goal is to deliver within budget and time. They also conclude that if project success is the focus, factors such as early planning and involvement become more critical. Cooke-Davies [17] has developed a model that describes three categories of success factors: (1) success factors necessary for achieving project management success, (2) success factors for achieving project success, and (3) success factors for achieving organizational success.

In recent years, there has been a growing tendency to take into account the factors that represent important values in projects such as trust, commitment, loyalty and openness [18-24]. Success in projects therefore depends on a variety of cultural factors that are important to create a positive and inclusive working environment.

Fortune and White [25] have reviewed 63 publications that focus on critical success factors in project management literature in order to examine the agreement between these publications regarding project success. Fortune and White [25] concluded that there is only limited agreement in literature on the factors that influence project success. This lack of concurrence has also been identified earlier by [26].

The lack of concurrence on the factors that influence project success has led researchers to focus attention on applying contingent approach to determine success factors in projects [27]. For instance, Shenhar, et al. [28] distinguish between general and project specific success factors. Recent work by Rolstadås, Tommelein, Schiefloe and Ballard [29] and Shenhar and Dvir [30] has shown that in order to succeed it is necessary to adjust the way in which the project is managed to adapt it to the project context. Shenhar and Dvir [30] have therefore

developed a conceptual model that describes projects in terms of four different characteristics: (1) degree of innovation, (2) degree of complexity, (3) degree of need for new technological solutions, and (4) how fast the project will be carried out. Similarly Rolstadås, et al. [29] have developed a conceptual model that link project management approach to critical success factors.

An important conclusion from the recent studies on project success suggest that projects are not always unique and can have different contextual factors and different degrees of these contextual factors. Each project therefore requires a different approach depending on the extent of each project characteristic.

Justification of the Study

The purpose of this paper is to establish a contingent framework that identify possible correlation between critical success factors and project characteristics. The framework presented in this paper is based on analysing 21 project cases. The cases cover diverse types of projects relating to various industries and businesses and give a good picture of how projects and project management are performed in Norway. The cases were collected during a series of continuing education courses in project management for business professionals held by the author at the Norwegian University of Science and Technology (NTNU) in the period 2009-2014.

Some professionals were taking the course as a part of the mandatory prerequisite to take a master's degree in leadership at NTNU, while others were taking the courses in order to seek a more in-depth understanding of methods and practices in project management or were attempting to secure a new career opportunity in project management. A summary profile of the course participants in terms of the type of industry they worked in and their job title is presented in Table 1.

Example of industry type	Example of job title
Offshore modifications	R&D Project Manager
Air traffic control	Senior Advisor
Consulting	Project Manager
Higher education	Project Leader
Facility management	Support Manager
Automation/Industrial IT	Project Coordinator
Medical	Maintenance Manager
Railway	Department Manager
Construction	Maintenance Planner

Table 1. Profile of course participants by type of industry and job title

The cases were collected using a questionnaire that consisted of open questions that the participants were asked to answer in writing. In these questionnaires, the participants were asked to describe in detail a project that they had contributed to as either project team members

or a project manager. The participants were also asked to identify the challenges that had been encountered, the means that were used to respond to the challenges, as well as to provide information about project context, and explain how the project was organized, planned, and executed.

In the period 2009–2014, the author collected c.400 project cases from different types of industries and applications. The size of each delivered case description was c.4–8 A4 pages (2000–4000) words). As the size of the database increased, and from in-class discussions with course participants, it became apparent that a number of factors had contributed to challenges and problems in the reported cases. One important group of factors that contributed to the challenges was lack of full awareness about both the project and its operational context. In many cases, a project was treated as *an effort* that should be completed within agreed upon constraints of time, budget, and scope, regardless of the context. This view of projects does not capture the full reality of the project life cycle and its context. Failure to acknowledge other important attributes of the project effort beyond the constraints of time, cost, and scope had given rise to problems and challenges in the reported cases. However, there was enough evidence in the cases to support the hypothesis that implementing suitable measures to address different project characteristics contributed to success or at least reduced the level and scope of the reported challenges. A detailed study was therefore initiated by the author to examine these observations closely. The study had the following tasks:

- To identify a list of all measures that had been applied in the reported cases in order to deliver the projects and achieve their objectives
- To identify the most important project characteristics embodied in the reported projects and compare the findings with reported findings in project literature
- To establish a correlation between success factors and the most important project characteristics
- To develop a conceptual model of project success based on the insights gained from the study

2 LITERATURE REVIEW

2.1 PROJECT CHARACTERISTICS

Because of the multiplicity of forms and purposes of projects, there are a number of different definitions of what constitutes a project. For example, Turner [31] defines a project as '*a temporary organization to which resources are assigned to do work to deliver beneficial change'*. The Project Management Institute [32] defines a project more narrowly, as '*a temporary endeavour undertaken to create a unique product, result or service*'. Other such, as

PRINCE2 [33], define a project as '*a temporary organization that is created for the purpose of delivering one or more business products according to an agreed business case*'. Common to all definitions is that a project is regarded as a temporary assignment that has a defined purpose and a set of characteristics that distinguish project assignment from repetitive tasks [34, 35].

Grasping the scope and extent of project characteristics is necessary in order to comprehend the challenges that these characteristics contribute to project execution. This understanding is also crucial for the choice of how information should be shared and managed, for the choice of execution model, and for the selection of project organization structure and authority level to name a few. The most common project characteristics defined in the project management literature include:

- Organizational complexity
- Projects contribute to transformation
- Projects have impact on business or strategy
- Projects are executed under one or more types of constraints
- Uncertainty

Organizational complexity

Organizational complexity is one of several dimensions that cause complexity or complications in projects [36-39]. Organizational complexity arises because of the magnitude and diversity with regard to the suppliers, the internal and external resources, and the skills needed in order to achieve the project objectives. Diversity reflects the degree of variation among stakeholders or within the project scope. Diversity of stakeholders include diversity in their geographical location, their national culture, their working practices, their awareness of objectives (goal perception), and variety of skills or disciplines used in the project. This notion of diversity corresponds with the concept of differentiation described by [36]. Clearly, the extent of this organizational complexity will vary depending on the complexity of the project's end product.

Projects contribute to transformation

Transformation or change is a broad and abstract concept, and is emphasized by many researchers as a key attribute of project assignments [34]. Change is about altering all or parts of the '*now situation*' to a new desired state using the product, service, or result that the project was initiated to deliver [40]. The need for transformation or change is not evident in all types of projects but it is a fundamental concept in restructuring projects and in IT projects initiated to improve existing working processes. In this context, change may mean changing the way employees work to rationalize existing operational processes. Change can also mean the development of new products or processes in order to eliminate quality defects in products or

the services an organization offers. People play a vital role in this process of change due to their potential for resistance or opposition to change [41]. The degree of change can be very extensive, such as in restructuring projects. In some cases, the change is limited to a small improvement in the existing product or process.

Projects have impact on business or strategy

The concept of transformation is not limited to the changes concerning the way employees work to rationalize existing operational processes. In a wider perspective, transformation means that projects are a means to realize business objectives or strategies [42-48]. The business or strategic perspective therefore plays a key role in the selection, allocation, and prioritization of resources to various projects an organization operates [49, 50]. The importance of a project in an organization may therefore vary depending on the impact the project has on the business or strategy. Cooke-Davies [17] goes even further and suggests that one of the most important conditions for organizational success is to link project success to business objectives or strategy.

Projects are executed under one or more types of constraints

Another important feature of project assignments is that they are accomplished within one or several constraints, such as time constraints, budget constraints, specifications or resource constraints [32]. A time-constrained project implies that the project must be completed within a specified time or deliver to the market on a certain date to achieve a benefit [35]. The time window for some of these projects is critical due to the market situation or because of requirements from the client or public authorities, such as the case *Installation of underfloor heating in a sampling cabinet*. Other constraints may include compliance with strict quality standards from a client. *Construction project B4* is an example of a project characterized by many constraints.

Uncertainty

Uncertainty is an inevitable aspect of most projects, but even the most proficient managers have difficulty handling it [51]. Novelty is considered to be a major source of uncertainty in projects [52, 53]. There are many facets of uncertainties in projects and there are many causes of uncertainty. However, there is a common consensus that uncertainty is affected by many factors but can be perceived differently by different people working on the same project. According to Geraldi and Adlbrecht [54] some aspects of uncertainties are more about faith than facts. Atkinson, Crawford and Ward [55] distinguish between three types of uncertainties in projects:

1. Uncertainty in estimates: includes lack of assurance regarding how much time and effort will be required to complete a particular activity. The sources of uncertainty may result from vagueness, ambiguity, lack of data, assumptions, known and unknown sources of bias [56], limited control of relevant project players, and ignorance about how much effort it is worth expending to clarify the situation.
2. Uncertainty associated with people. This includes uncertainty regarding the project parties' willingness and ability to commit or perform as required or expected.
3. Uncertainty associated with managing each stage in the project life cycle. Sources of uncertainty include proper allocation of resources, determining the level of follow-up, and determining routines for control changes.

Cleden [57] argue that in order to manage uncertainty the project manager must ask the right questions, be continually sceptical of the answers received and act where possible only on the basis of impartial evidence.

The above types of uncertainties are classified by Ramasesh and Browning [58] as the Known-Unknown uncertainties and can be addressed through the conventional techniques of risk and opportunity management. Ramasesh and Browning [58] have also studied the unrecognized uncertainties known as (Unknown Unknown) or Unks. Unks. They argue that the driving factors for failing to recognize the unk. unks. could be attributed to, among other things, behavioural issues such as overreliance on past experiences, biases, heuristics and dysfunctional project culture.

3 RESEARCH APPROACH

In this study, qualitative case study research has been used to develop insights into the correlation between project success and project characteristics. Baxter and Jack [59] suggest that case study research fits within the constructivist paradigm. This paradigm recognizes the importance of the subjective human creation of meaning, but does not reject outright any notions of objectivity. One of the advantages of case study research approach is the close collaboration between the researcher and the respondents or participants, while enabling them to tell their stories. Through their stories, the participants are able to describe their views of reality and this enables the researcher to gain a better understanding the participant's actions. According to Yin [60], a case study approach should be considered when: (1) the focus of the study is to answer 'how' and 'why' questions; (2) the behaviour of those involved in the study should not be manipulated; (3) the aim is to cover contextual conditions because they are believed to be relevant to the phenomenon under study; or (4) the boundaries between the phenomenon and context are unclear.

4 Findings

The analysis was conducted in three rounds. The purpose and the outcome of each round is described in the following sections.

4.1 Findings from the first round

The goal of the first round of the analysis was to identify the factors that contributed to success or challenges or failure in each project case and to assess the extent of each project characteristics described in the literature review section. Project business professionals who were attending project management education courses that the author held at NTNU, contributed to the analysis. Each participant was assigned one project case and the task given was to conduct a systematic analysis of each project case. Each project case was analysed 2-3 times in average and the task given to each participant was:

- Study the project case thoroughly and identify all the factors that contributed to success or challenges in the assigned case
- Identify the extent of each project characteristics in terms of extent of organizational complexities, extent of intended transformation, extent of impact on business, extent of constraints and extent of uncertainty.

The identification of factors and characteristics was based on a subjective assessment of each case, and the quality of the assessment was dependent on the following:

- The quality of the written case
- Participants ability to include or reflect on all possible factors that were critical; there was a risk that some factors had been forgotten or ignored
- The experience of the participants who analysed each case.

All responses were submitted in writing, a total of 75 responses has been collected by the end of the first round. The results of the detailed analysis of each project case yielded a set of 4-8 success / failure factors for each case. A sample summary of all success factors that have been identified from the cases that was completed without any reported challenges is shown in Table 2. In addition, a sample summary of all factors that contributed to delays, cost overrun and unintended results in some cases that was challenged is shown in Table 3.

Table 2. A sample summary of the success factors of project cases that was completed without reported challenges.

Case (projects that were completed successfully)	Success factors
Recruitment of men to the health sector in Norway	Clarity of purpose and objectives Commitment and creativity of the project manager Project manager with adequate business insights Inclusive and respectful project manager Adequate information flow to stakeholders. Involvement of recruits Support from project owner Conscious media strategy in order to reach wider audience
Fast-track joint replacement surgery in a regional hospital	Clarity of purpose and objectives Cooperation between the units that would be affected by the fast-track project. Adequate and timely information flow to stakeholders. Close follow-up of the suggested measures and making necessary changes as the project developed. Emphasis on loyalty to the decisions taken in the project group. Project manager had adequate decision-making authority and was supported by line management.
Renovation of a municipality's maritime museum	Adequate planning Adequate requirements process Structured risk assessment Motivated and skilled project team Oversight by project owner Involving stakeholders Supportive project owner Unforeseen situations were handled in a good way (trouble shooting)

Table 3. A sample summary factors that contributed to undesirable results in the challenged projects

Case (Challenged projects)	Factors that contributed to undesirable results (delays, additional costs, unrest, dissatisfied customer, and more)
Planning and construction of a new upper secondary school.	Inadequate description of scope of work at start up Underestimation of risk factors Ambiguous specifications for some deliveries No clear roles or responsibilities in the project group Lack of cooperation / poor relationships between the project owner and the contractor in the early stages. Unstable project organization on the contractor side Lack of competence (project group on the project owner side)
Downsizing by introducing speech recognition software in a regional hospital	Lack of end-user's involvement Lack of risk assessment Lack of insights into the end-users willingness to use new systems Over focus on financial gains Underestimation of the needs of end-users
Installation of underfloor heating in a sampling cabinet for a client	Lack of risk assessment Lack of scope definition Overoptimistic estimates Overfocus on finding technical solution Lack of routines for change control Inexperienced project manager Basing execution on unverified assumptions

4.2 Findings from the second round

In the second round of analysis, the author systematically went through and reviewed all the submitted responses, coded and consolidated all failure and success factors identified by the participants. The result is 36 success factors identified from all of the examined cases, as shown in Table 4.

Table 4. Summary of the success factors from the examined project cases

Commitment (project manager, team, top management, project owner)	Adequate early planning	Oversight / follow up by top management
Clarity of roles and responsibilities for those involved in the project	Loyalty to decisions	Use of appropriate project execution model (agile, adaptive, plan driven)
Project manager / management has adequate business insights (understand the needs of various group, understand the impact of the project on the users)	Project manager with adequate decision-making authority / appropriate project organization structure	Collaboration between stakeholders/ contractors / line management and project
Inclusive project manager	Honesty in reporting	Follow-up and feedback by project manager
Mobilization and provision of support from project owner / line management / top management	Clarity of priorities and structured requirements process	Creativity of the project manager / team
Mindfulness about biases, heuristics such as overoptimism, narrow focus and assumptions	Experience (project manager, contractor, and team)	End-user/ client/stakeholders involvement
Skills, knowledge and competence (project manager and team)	Use of lessons learned from previous projects	Clarity of purpose and objectives
Alignment of organization to project purpose/ Communicate the importance of the project to the entire organization	Structured risk management process	Transparency (open and inclusive communication on all levels)
Motivation of project team / project manager	Flexibility (adaptability, autonomy, address problems as they arise)	Proximity to end-users, management and human resources
Adequate documentation and reporting	Adequate and timely information flow between project and stakeholders	Established routines for deviation / change control
Trust (within team or between client and contractor	Stability / continuity of project organization	Collaboration within the project organization (One team)
Continuity of project development (short waiting time between phases)	Balanced project group that represent the interests of all the units/ stakeholders that will be affected by the project	Selection of optimized solutions/deliverables

Information shown in Table 4 may suggest that we could distinguish between 3 categories of success factors:

- Case-specific factors that are relevant to a specific situation and cannot be generalized to other contexts. Examples include the execution style, relationship to vendors, type of contract selected and use of specific methods. For example, it was mentioned in the case

Recruitment of men to the health sector that the project manager used TV and newspaper ads in order to reach a wider group of recruits. Using ads is a method that cannot be generalized to all types of projects.

- Context-dependent factors. An overview of these factors is shown in Table 5.
- Cultural factors that represent important shared values. Trust, openness, respect, loyalty, and commitment are among the important values that must be complied with in order to have a good working environment in which project team members / contractors / project organization could improve their tasks continually. A good working environment that is characterized by openness, respect, loyalty, trust and dedication has considerable influence on motivation, creativity, cooperation, unity, sense of ownership, and knowledge sharing. Lack of these values could cause power struggles, resistance, indifference, and ultimately failure in projects.

Table 5. Summary of the context dependent factors from the examined project cases

Clarity of roles and responsibilities for those involved in the project	Adequate early planning
Clarity of project priorities (what is important to consider) and structured requirements process	Oversight / follow up by top management/ project manager. Adequate documentation and reporting
Project manager / management has adequate business insights (understand the needs of various group, understand the impact of the project on the users, inclusive)	Project manager with adequate decision-making authority / appropriate project organization structure. Stability / continuity of project organization
Mobilization and provision of support from project owner / line management / top management	Experience, skills, knowledge and competence (project manager/ contractor, and project group)
Clarity of purpose and objectives	Structured risk management process. / Use of lessons learned from previous projects
Mindfulness about biases, heuristics such as overoptimism, narrow focus and assumptions	Alignment of organization to project purpose/ Communicate the importance of the project to the entire organization
Collaboration between stakeholders/ contractors / line management and project (one-team)	Use of appropriate project execution model (agile, adaptive, plan driven)
Established routines for deviation / change control	End-user/ client/stakeholders involvement. Balanced project group that represent the interests of all the units/ stakeholders that will be affected by the project
Flexibility (adaptability, providing autonomy, address problems as they arise)	Adequate and timely information flow between project and stakeholders

4.3 Findings from the third round

The third round of analysis focused on further classifying the success factors outlined in Table 5 along the 5 project characteristics outlined in the literature review section. In this round of analysis, smaller groups consisted of 2-3 business professionals were established in order to allow more in-depth discussions between the participants. Participants in each group were

instructed to assume that they are about to lead a project that exhibited only one of the 5 characteristics, examples from the cases were provided to the groups. The task that was given to them was to select 3-5 critical success factors for that project using the factors listed in Table 5. Prior starting the assignment, the author went through the list of factors in Table 5, explained what they mean and revisited and explained the concept of project characteristics outlined in section 2. The responses were then collected, grouped and presented to the participants to obtain their comments and feedback. The comments and feedback from the participants was then used to modify the suggested classification. The process was then repeated for another group of course participants. The result from these classification exercises is shown in Table 6.

Table 6. Classification of success factors according to project characteristics

Characteristic	Critical Success Factors
Organizational complexity (The project requires contribution from large number of organizational units/ individuals)	Timely and purposeful information flow to various stakeholders Clarity of roles and responsibilities Project manager with adequate decision-making authority / appropriate project organization structure. Stability / continuity of project organization
Transformation (purpose of the project is to introduce substantial changes to existing work processes, systems or procedures)	Clarity of purpose and objectives End-user/ client/stakeholders involvement Balanced project group that represent the interests of all the units/ that will be affected by the project Project manager / management has adequate business insights (understand the needs of various group, understand the impact of the project on the users, inclusive)
Impact on business (the project has substantial impact on the business or on corporate strategy)	Alignment of the organization to project purpose/ Communicate the importance of the project to the entire organization Mobilization and provision of support from project owner / management Oversight / follow up by project owner / management
Constraints (the project should be completed under one or several types of constraints, such as time, resources, requirements from authorities or other stakeholders)	Adequate early planning Established routines for deviation / change control Collaboration within the project organization. Collaboration between project/contractors/ (One team). Clarity of priorities and structured requirements process
Uncertainty (the project has considerable level of uncertainty regarding the scope of work, impact, methods or the outcome	Flexibility Structured risk management process. / Use of lessons learned from previous projects Experience, skills, knowledge and competence (project manager/ contractor, and project group) Mindfulness about biases, heuristics such as overoptimism, narrow focus and assumptions

It is important to emphasize that this classification is not final and is based on a limited sample of responses, and therefore it is still subject to modifications and changes.

5 Discussions

A short description of each factor is given in the following sections.

Organizational complexity

Timely and purposeful information flow to various stakeholders is a critical success factor in projects that requires contribution from multiple organizational units or multiple stakeholders. Evidence from cases suggest that it is crucial that all key stakeholders (top management, project participants, users and other key stakeholders) are kept informed about conditions that were important for them, in order to enable them to contribute to the project either in terms of support and supervision or in the form of professional competence or as decision-makers. The need for an adequate and timely flow of information is proportional to the organizational complexity, as supported by several researchers [61-64]. Additionally, adequate information flow is important to assure stakeholders that their expectations or interests will be advocated.

> *One important success factor in this project was regular reporting and information to both the project team and the contractors in order to detect deviations*

Clear roles and responsibilities: This is an important success factor because in light of organizational complexity, the involved organizational units and individuals should know what their responsibilities and functions in the project are, particularly in terms of who has decision-making powers. Evidence from the cases indicates, for example, that projects are often run in parallel with other tasks and projects, and it was difficult to prioritize one particular project. Therefore, clearly defined roles and responsibility are necessary when project staff also have other functional duties. This factor has also been emphasized as a prerequisite for project management success by Cooke-Davies [17].

> *Thorough review of who does what. The project, construction, and engineering design managers all complemented each other rather than adopting a hierarchical approach.*

Project manager with adequate decision-making authority / appropriate project organization structure. Empirical data from the cases indicate that a project manager with a high level of authority will find it much easier to manoeuvre in a complex organizational structure than a project manager with a lower level of authority. Lower authority levels must be compensated for with good, clear support from senior management.

> *The project's strength and success is related to the clear division of roles in the project organization and the fact that the project manager had sufficient authority.*

For projects that have high degree of organizational complexity, evidence from the cases revealed that it is critical to have an organizational structure in which the project is in focus and the project manager has adequate decision-making powers that correspond to the level of responsibility assigned to him or her. This requirement is also in line with recommendations made by Turner [31]. Similarly Might and Fischer (1985) found that the level of authority entrusted to the project manager is positively related to all internal measures of success (meeting budget, time-table and technical requirements.

Transformation

The development of a good understanding of why changes are needed is a critical success factor. There will always be resistance to change unless employees agree that change is possible and feasible, and that change will be beneficial to them [65]. This implies and requires **Clarity of purpose and objectives.** This is important for reducing resistance to changes in the organization, which are quite common in transformation projects. End users should be able to understand and see the need for change, which can then be a motivating factor to reduce resistance in both the project implementation phase and the operational phase.

> *An important success factor for this project was that everyone within the organization acknowledged the need for the project and wanted to achieve its purpose.*

End-user/ client/stakeholders involvement. Several researchers have already shown that the involvement and participation of end users is an important success factor [66-68]. Usually the end users will be affected by the changes after the project is finished. Resistance or reluctance to change may occur due to: (1) a project leading to changes in working practices, (2) a project changes employees' social groups, (3) there is an embedded fear of anything new, and (4) employees risk losing their position or financial benefits [65].

A participatory process that empowers those who will undergo transformation is therefore a prerequisite for success. The participatory process implies establishing a **project group that represent the interests of all the units/ that will be affected by the project**. This is an important prerequisite for selecting solutions that do not lead to shockwaves among employees or to unfamiliar fallouts. A project should therefore focus on finding new comfort zones for those who will be affected by changes through involvement in the selection of possible solutions to achieve these changes or through selection of, for example, an appropriate training regime. This involvement and participation must be there from the project start.

> *The vast majority of employees in any organization are likely to be protective of what they regard as familiar, and therefore any change can cause turmoil and trigger the need for more involvement and information than usual.*

Project manager / management has adequate business insights. A project manager who understand the needs of various group, understand the impact of the project on the users and organization is a prerequisite in order to have an overview of how the organization will be affected by the project and who will be affected. With expected major changes compared to the current state, it is important that the project manager can analyse and understand what effects this transformation will have on people, systems, processes, and the environment, in order to direct the changes effectively. Much of the project management effort is actually about aligning and balancing different perspectives. Achieving this balance requires a good understanding of the business and its context.

Business perspective

If a project has considerable impact on the organization strategy or business, it will become necessary to **communicate the importance of the project to the organization**, both downwards and upwards, in order to create ownership of the purpose and objectives of the project. It is important that project staff acknowledge the importance of the project for the whole organization. This can be communicated through a clear charter or a business case that also shows the significance of the project to the organization. According to Anantatmula [19], communication of the business objectives and expectations of the project is essential in order to create *inspiring stimulation*. In turn, this is important in order to encourage employees to manage their tasks within the framework of the overall objectives of the project.

There are many challenges to the provision of enough resources for a project. The ability to mobilize and to provide support and attention to the most important parts of the project that are necessary for success is important too. **Support from project owner/ senior management** in the form of the provision of resources and intervention when conflicts with other ongoing projects arise is critical for success. Evidence from the cases suggest that supportive top management can make a difference even when the project is based on ambiguous requirements.

> *It is quite clear that a lack of project plans and an unclear project manager role were prevented by the strong presence of the senior management, who provided a good overview, strong professional insight, great vigour, and great implementation capability. This, coupled with short communication lines, compensated to some extent*

> *for the lack of project organization. Stability in the project team helped to reduce the project's vulnerability.*

Oversight / follow up. Systematic follow-up from project owner / top management to project management is an important signal of how seriously top management take project progress [49, 69, 70]. This is a necessary function to: (1) ensure that all project participants are working towards the same goal, and (2) retain control over the progress of the project. Therefore, it is also important that top management have good performance criteria for monitoring the project. Follow-up may involve less measurable variables such as problems and difficulties that must be handled when they emerge.

Oversight and follow-up from implies providing clear feedback and priorities. Foss and Christensen [71] argue that close follow-up reduces the risk of project staff developing an egoistic approach to their work. In the absence of good follow-up, project staff might perform what they themselves think is interesting and will not conform to the overall guidelines and expectations. Too much autonomy can cause unfortunate consequences if project participants experience it as a lack of management. Oldham and Hackman [72] believe that giving feedback is important for motivation, as well as for personal development.

Constraints

In the presence of many constraints, such as a limited time window, limited resources, budget or extensive requirements, the findings of our study suggest that one cannot adopt an ad-hoc approach to project execution. **Adequate Early planning** is a key success factor in order to understand the scope and complexity of the project as early as possible. Scope definition, scheduling, resource planning, estimation, and risk assessment are therefore necessary processes in order to visualize and communicate various project constraints to various stakeholders. Early planning of the project will help to ensure that the desired resources are acquired for project implementation.

> *Spend more time to resolve issues early in the project so they do not escalate and hang throughout the project.*

Early planning is an example of proactive leadership of projects. It helps the project manager to be prepared and have a good overview of how the project should evolve. Nevertheless, discrepancies, errors, and adjustments during project execution may arise as a result of various internal and external causes. Therefore, the project must have a system for dealing with such

unforeseen situations. **Established routines for deviation / change control system** consists of procedures and measures that are used when deviations occur. The purpose of such a system is to implement corrective measures that have minimal impact on the project. This will reduce the risk of increased costs, time, or lower quality.

> *A major challenge in the execution phase was that the design was incomplete, and was therefore developed as the project evolved. This led to many changes in work processes, as well as shifts and delays in the work schedule, and the associated challenges that this created for the lifetime of the materials and changes to the tools-concept.*

Collaboration within the project organization and between project organization and contractors/vendors**.** Establishing collaborative team (one-team) is a critical success factor when the project is characterized by significant constraints. collaborative teams have some common basic features, such as having common goals, interdependence, solidarity, mutual trust, motivation, and determination. Thus, the one-team concept comprises having the right people who are motivated and competent, and who see and acknowledge that they rely on each other to meet project goals. The concept of one-team is not only limited to internal project staff but also includes the suppliers and contractors.

> *Contractors – it was important to have them on-board; establishment of contracts in which both parties had confidence, acceptable limits, mutual trust, and common goals for success; transparency throughout the entire project*

Building one-team is a difficult task due to various personnel, bureaucratic, and organizational barriers [73]. One of the most important factors that can help in the building of a team is to create both unity and understanding of the mutual relationship between the various team members' tasks [35]. This is a demanding task and should therefore be initiated as early as possible in the project.

Communicate priorities and adopt adequate requirements process. A good and systematic approach to requirements management is an important precondition for complying with various expectations, limitations, and guidelines [74]. In this respect, it is perhaps important to keep track of all requirements for the project and its results. This may include operational requirements, requirements for approval, requirements for implementation, technical requirements, functional requirements, and other requirements covering the entire life cycle of the product [75-79]

Uncertainty

Uncertainties related to estimates arise because of changing requirements, lack of knowledge about the scope of work due to ambiguity, numerous and diverse expectations, and newness of the product. **Flexibility** has been suggested as a suitable counter measure to handle uncertainty. Flexibility enables decisions to be continually adapted during both the planning and execution of the project. Flexibility is achieved through several measures. Flexibility can be by using adaptive methods with small deliveries may make a project less vulnerable to changes [80-82].

Flexibility can also be achieved by providing the project team with a degree of **Autonomy** to expand, prioritize, and respond to changes in scope as they see fit. Autonomy is a sense of freedom and independence in one's work. It is an important factor in creating what organizational theorists call *intellectual stimulation [83]*. Autonomy is also important for maintaining motivation, dedication, and learning.

The ability to handle emerging issues is another dimension of flexibility, especially when the project management does not have the opportunity to predict all possible challenges in advance [11, 16, 84]. In this situation, decision-making requires critical and analytical judgment, and is based on facts and experiences. This applies even when leaders are presented with incomplete and ambiguous information. Müller and Turner [85] show that to be successful, project managers have a strong need for this competence.

Another approach to deal with uncertainty in projects is the use of **project risk management** as a tool to increase the predictability of the project and to avoid unpleasant surprises during the project. Predictability becomes even more important when the project has to be implemented within stricter limits, such as time pressure. An additional success factor that is important for projects with high degree of uncertainty is the appointment of staff with the relevant **skills and competences**. If the team members have the relevant qualifications, it will be easier for them to deal with uncertainties [86]. They will know what to prepare for and how to deal with it.

Mindfulness about systematic biases and heuristics. People bring to projects their habits, perspectives, and delusions from previous projects, and this can lead to flaws in the way they work, or in the way they take decisions during project execution [87-89]. Findings from the cases indicate how important it is to be aware of the impact of these systematic biases and heuristics during decision-making in projects. Examples of biases found in the cases include; narrow focus [90]. Because of this bias, the decision-makers may fail to identify the real needs and expectations of the various stakeholders which might lead to higher degree of uncertainty.

Another example of biases in projects is the tendency to compensate for lack of information about the project or its context with unverified assumptions [91]. This tendency can be explained by 'bounded rationality bias'[92]. Bounded rationality occurs when decision-makers: (1) have limited and unreliable information, (2) have limited capacity to assess and manage the information that is available, and (3) are under time pressure to make a decision. In such circumstances, decision-makers will try to reach a satisfactory solution because they lack the skills and resources to arrive at an optimal solution. Another example of biases from cases is overoptimism, which occurs when decision-makers have high expectations that are unsupported by any objective evidence. Overoptimism has a direct impact on, for example, project cost and time estimates [93]. Another factor that is often referred to is the effect of groupthink. Groupthink can reduce the project team's ability to request answers to critical questions about implementation, context, or other factors [94]. This bias might lead to irrational decisions, self-censorship, and the illusion of unanimity.

6 Conclusions

The paper presents a categorization of project success factors that should help project management professionals to select and prioritise the factors that are critical for project success. The paper presents and classify 18 success factors and discuss their criticality depending on the context of the project. The project context is presented using 5 characteristics that has been identified from project management literature. Grasping the scope and extent of project characteristics is necessary in order to comprehend the challenges that these characteristics contribute to project management. The project characteristics include:

Organizational complexity. Organizational complexity arises because of the magnitude and diversity with regard to the suppliers, the internal and external resources, and the skills needed in order to achieve the project purpose. The extent of this organizational complexity will vary depending on the complexity of the project's end product. Findings suggest that the following factors are critical to adhere if the project is organizationally complex:

- Timely and purposeful information flow to various stakeholders
- Clarity of roles and responsibilities
- Project manager with adequate decision-making authority / appropriate project organization structure.

Transformation: Transformation or change is a key attribute of many project assignments. People play a vital role in this process of change due to their potential for resistance or

opposition to change. Findings suggest that the following factors are critical to adhere if the purpose of the project is to introduce substantial changes to existing work processes, systems or procedures:

- Clarity of purpose and objectives
- End-user/ client/stakeholders involvement
- Balanced project group that represent the interests of all the units/ that will be affected by the project
- Project manager / management has adequate business insights (understand the needs of various group, understand the impact of the project on the users, inclusive)

Projects have impact on business or strategy. The concept of transformation is not limited to the changes concerning the way employees work to rationalize existing operational processes. In a wider perspective, transformation means that projects are a means to realize business objectives or strategies. The importance of a project in an organization may therefore vary depending on the impact the project has on the business or strategy. Findings suggest that the following factors are critical to adhere to if the project has substantial impact on the business or on corporate strategy:

- Alignment of the organization to project purpose/ Communicate the importance of the project to the entire organization
- Mobilization and provision of support from project owner / management
- Oversight / follow up by project owner / management

Projects are executed under one or more types of constraints. Another important feature of project assignments is that they are accomplished within one or several constraints, such as time constraints, budget constraints, specifications or resource constraints, Other constraints may include compliance with strict quality standards from a client. Findings suggest that the following factors are critical if the project should be completed under one or several types of constraints:

- Adequate early planning
- Established routines for deviation control
- Collaboration within the project organization. Collaboration between project/contractors/ (One team).
- Clarity of priorities and structured requirements process

Uncertainty. There are many facets of uncertainties in projects and there are many causes of uncertainty. Uncertainty is strongly linked to newness or novelty of the product or service the project will deliver. Findings suggest that the following factors are critical to adhere to if the

project has considerable level of uncertainty regarding the scope of work, impact, methods or the outcome:

- Flexibility
- Structured risk management process. / Use of lessons learned from previous projects
- Experience, skills, knowledge and competence (project manager/ contractor, and project group)
- Mindfulness about biases, heuristics such as overoptimism, narrow focus and assumptions

The empirical findings from this study suggest that Trust, Openness, Respect, Loyalty, and Commitment are important shared values. These shared values are not correlated with project characteristics but are important to create a good working environment in which project team members improve their tasks continually. In addition, these values have considerable influence on motivation, creativity, cooperation, unity, sense of ownership, and knowledge sharing. Lack of these values could cause power struggles, resistance, indifference, and ultimately failure in projects.

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